The Constellation-X Observer

http://constellation.gsfc.nasa.gov Volume 2, Issue 1: Spring 2008

Opening the Window of X-ray Spectroscopy – Tracing the Energetics of the Universe

Mission Updates

The February FST meeting in Boulder, CO was a success, featuring both an update on the mission (including major progress on the mirrors) and a series of presentations from the fourteen science panels. The meeting agenda complete with presentations is available at http://conxproj.gsfc.nasa.gov under the Resources→Meetings link.

The next Constellation-X facility science team (FST) meeting will be held August 20-22, 2008 at NASA/GSFC. FST meetings are always open to anyone interested in the mission, but foreign nationals should contact Ms. Sandy Barnes (Sandra.L.Barnes@nasa.gov) as soon as possible to obtain a badge. The meeting will focus on presentations to be made to the upcoming decadal survey, focusing on results from the newly restructured science panels.

The Con-X event simulator, simx, is now available at http://constellation.gsfc.nasa.gov/resources/simulators/index.html. Using a user-chosen spectrum and image, simx generates an event file that can be analyzed using standard tools such as ds9.

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Technology Development Update

The Spectroscopy X-ray Telescope team has had a number of recent successes, most notably a test of a two-mirror system in the 600m beamline at NASA/GSFC that achieved 14.7 arc sec HPD at 8 keV, in agreement with the optical metrology data. The pair of Ir-coated mirror segments were temporarily supported by a specially-constructed cradle-mattress system that negates the effect of gravity which could otherwise severely distort the figure of the mirror segments.

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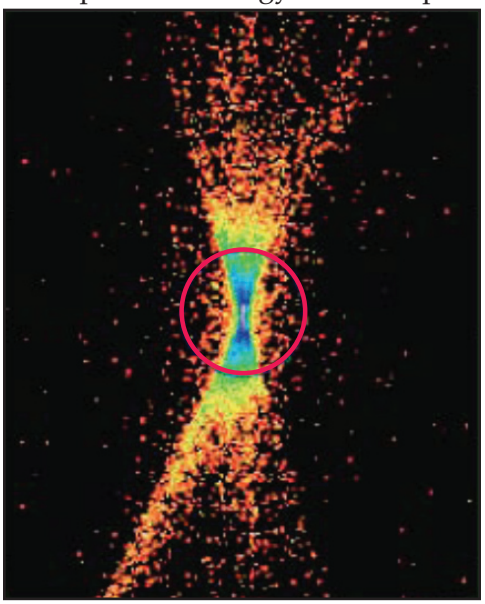
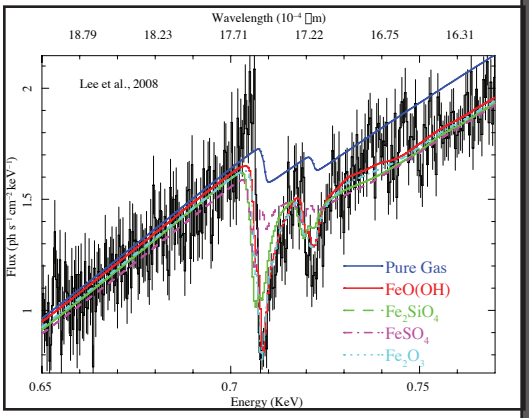


Two mirror segment image of point source, showing a 14.7 arc sec HPD at 8 keV.

Focus On: The ISM in X-rays

Constellation-X has the sensitivity and spectral resolution needed to study the interstellar medium (ISM) in all phases, whether cool, warm, or hot. Chandra and XMM-Newton have already measured absorption lines and edges from N, O, Ne, Mg, Si, S, Ar and Fe atoms and ions in both Galactic and extragalactic ISM towards bright X-ray sources (Lee et al. 2001; Juett et al 2006; Kaastra et al. 2007). The limiting factor is detector sensitivity. Shulz et al. (2005) have already shown that Con-X measurements will measure absorption edges from O, Ne, Mg, Si, S, and Fe as well as equivalent widths of resonance absorption lines from atoms, ions, and molecules in both the Galactic and extragalactic ISM. The figure at right shows how different iron molecules can be distinguished via the shape and depth of the edge. Lee & Ravel (2005) have even shown that the X-ray Absorption Fine Structure (XAFS) features that are created next to the edge due to the crystalline structure in a dust grain can be measured, allowing direct determination of the composition of interstellar dust. Con-X will also observe halos around sources due to X-ray scattering by dust grains, allowing direct measurement of grain sizes and composition.

More information about this topic, along with prepared powerpoint slides suitable for inclusion in your next talk, is available at **http://constellation.gsfc.nasa.gov/FocusOn/**



Chandra observation of an XRB absorption spectrum, focused on the iron L absorption edge around 0.71 keV (Lee, J. C., in prep.). X-ray absorption studies can determine not only the total iron abundance, but also the molecular composition of the iron. Similar observations focused on oxygen or other elemental edges can directly determine the abundance in multiple ionization states, or in molecular or solid form, reducing or eliminating the need for ionization and other corrections.

Mission Updates (con't)

If you have a question about material in the Constellation-X Observer, about the mission in general, or if you have material you would like to see in a future "Focus On" section, please contact the editors at conx-observer@lists.nasa.gov.

The Constellation-X Science panels have begun efforts to refine the mission science case. The panels cover the following topics:

Panel Topic	Chair
Missing Baryons/WHIM; synergy with UV spectroscopy	Mike Shull
Extreme States of Matter in Neutron Stars	Frits Paerels
Accretion Physics in Stellar Systems	Jon Miller
Census of Black Hole Accretion in the Universe	Nancy Levenson
Evolution of Large Scale Structure in the Universe	Steve Allen
Hot Baryons in Deep Potential Wells	Christine Jones
Testing General Relativity and Measuring Black Hole Spin	Chris Reynolds
Supernova/Stellar Feedback	David Strickland
Production and Distribution of the Elements	John P. Hughes
AGN Feedback: Outflows & Jets	Andy Fabian
MHD Physics in Stellar Environments	Rachel Osten
The high-z Universe, Re-ionization & Synergy with JWST "First Light" Science	Niel Brandt
Solar System, Planet Formation & Evolution	Eric Feigelson
Plasma Diagnostics and Atomic Astrophysics	Nancy Brickhouse

We welcome your input to these panels, either by email to conx-observer@lists.nasa.gov, attendance at the FST meetings, or by contacting the chairs of the panels directly. More information is available at the Constellation-X home page.

Technology Update (con't)

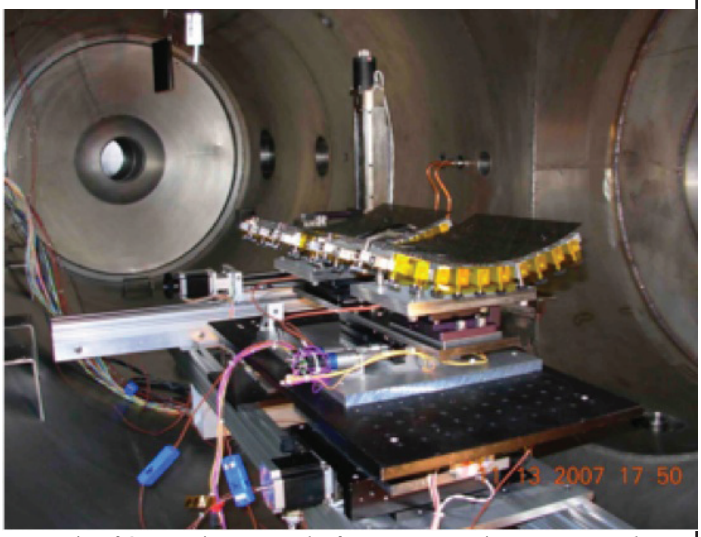
The good image and the good agreement between the X-ray measurement and prediction indicate:

(1) Directly slumped glass mirror segments are all but certain to meet the baseline Con-X requirement of 15 arc sec HPD. No post-slumping processing, be it epoxy replication or old-fashioned polishing, is required, realizing both budget and schedule savings for the project.

(2) The metrology process used for mirror segment evaluation is understood.

(3) The effect of gravity and other forces that can degrade the figure of the thin mirror segments can be understood, modeled, and countered.

The next steps are to better understand the different terms that contribute to the 14.7 arc sec image quality and assess the extent to which these factors can be reduced to move to the 5 arc sec goal. We are also continuing to work on designs and test ideas for how to transfer and bond the mirror segment into a permanent housing.



A pair of SXT mirrors ready for X-ray test in a vacuum chamber. The mirrors are temporarily supported by coils to negate the effect of gravity.

The ever-popular Constellation-X glasses are now back in stock! These amazing glasses, which contain prisms that demonstrate the power and beauty of spectroscopy to kids of all ages. Watch as wearers discover for themselves the difference between regular lightbulbs and fluorescent bulbs. Check out the Constellation X web page for details about the glasses and requesting some for your next education or public outreach project.